

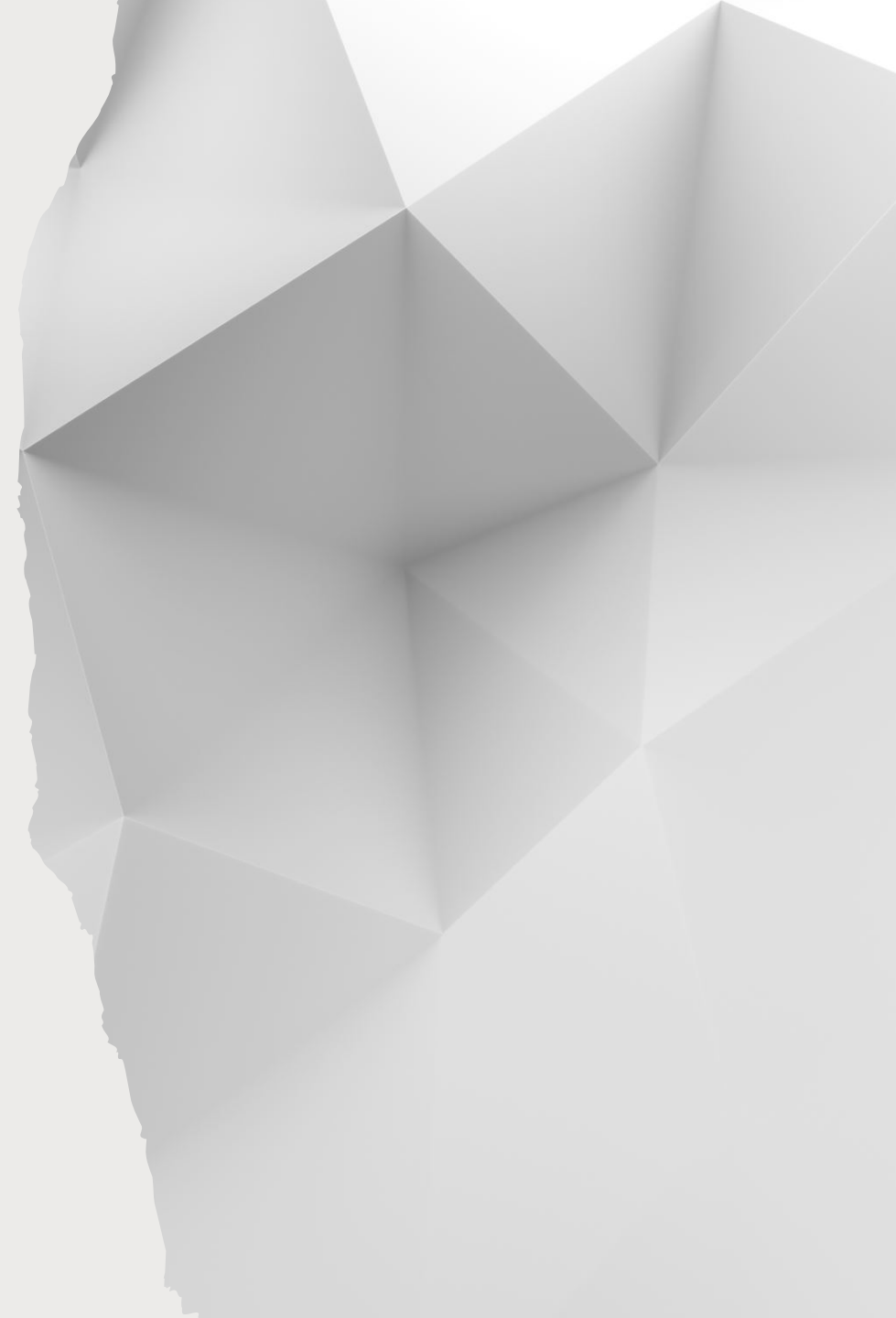
INTRODUCTION TO CHEMICAL SAFETY

Physics and Astronomy Basic Safety Training
Session – Sept. 5th, 2025

Presenter: Ryan Stolley, PhD

Assoc. Director - SRI, Chemical Safety Lead

Adj. Asst. Prof. - Chemistry



FUNDAMENTAL CONCEPTS

1

DON'T work with something until you fully understand its hazards and are comfortable working with it

2

DO use the Hierarchy of Controls to mitigate risk

3

DO wear appropriate Personal Protective Equipment (PPE)

4

DO label everything

5

DO store and dispose of reagents appropriately

UNDERSTANDING HAZARDS OF CHEMICALS

“How do I fully understand the hazards of what I’m working with?”

Utilize a combination of:

- Detailed experimental design “*what could I possibly use*”
- Safety Data Sheets (SDS) – Distributer, manufacturer, NIST, etc.
- Colleagues
- Standard Operating Procedures (SOPs) - internal & external.

**If you are pregnant or might become pregnant, consult with an occupational medicine physician before working around chemicals. You have a right to choose in you want to work in a lab or not.*

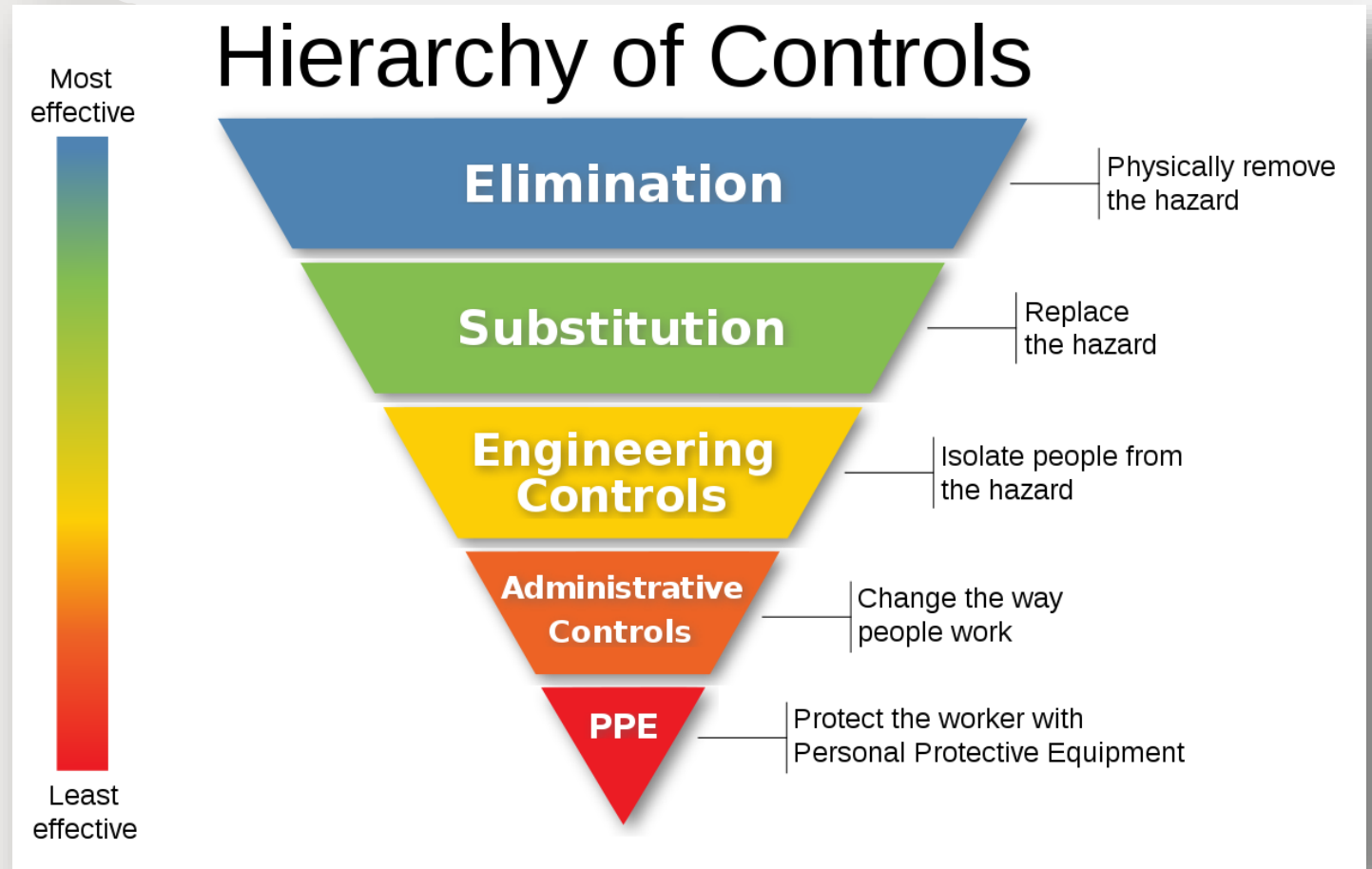
1

DON'T work with something until you fully understand its hazards and are comfortable working with it.
OSHA right of refusal

HIERARCHY OF CONTROLS

2

DO use the Hierarchy of Controls to mitigate risk



CHOOSING PPE

3

DO wear appropriate Personal Protective Equipment (PPE)

PPE should be chosen based on hazards and processes you're working with.

- You **DON'T KNOW** what others have done/will do.
- Minimum for “wet” lab (a lab containing chemicals or biologicals):
 - Safety glasses or splash goggles
 - Lab Coat
 - Fully closed shoes and full-length pants (or equivalent)
 - Gloves
- Material, type, etc. dependent on what you're doing
- Your PI should provide *appropriate PPE* for you
- All labs must have a PPE hazard assessment

CHOOSING PPE

Material, type, etc. dependent on what you're doing

3

DO wear appropriate Personal Protective Equipment (PPE)



Material, type, etc. dependent on what you're doing

CHOOSING PPE

3

DO wear appropriate Personal Protective Equipment (PPE)



Some features to consider:

- Material
- Cuffs vs no cuffs
- Closure Mechanism

LABEL EVERYTHING

4

DO label everything

For Reagent Containers:

1. Full Name
2. Additional Identifiers
3. Hazards (Sticker labels!)

For Unwanted Materials Containers:

1. Appropriate Container
2. "Unwanted Materials"
3. Name – % of Total
4. Hazards
5. Accumulation Start Date
(There are labels through SAM)



EtOH



Ethanol



**Ethanol (100%)
Hazards: Flammable, Chronic and
Acute Health Hazards**

Unwanted Materials – Liquids

**Ethanol – 30%
Acetone – 10%
Water – 60%**

**Hazards: Flammable, Chronic and Acute
Health Hazards**

Accumulation Start Date: 3/02/24

CHEMICAL STORAGE

5

DO store and dispose of reagents appropriately

Use Hazard Classes as Primary Tool to Segregate Chemicals

- Acids, Organic (Acetic Acid, etc.)
- Acids, Inorganic (Hydrochloric Acid, Sulfuric Acid, Nitric Acid, etc.)
- Bases, Organic (Diamine, Triethylamine, etc.)
- Bases, Inorganic (Sodium Hydroxide, Potassium Hydroxide, etc.)
- Flammables (Ethanol, Acetone, Hexanes, etc.)
- Oxidizers (Peroxides, Perchlorates, Nitrates, etc.)
- Water Reactives (Na/K/Li Metals, Alkali Metal Hydrides, etc.)

*Peroxide Formers (Diethyl Ether, THF, etc.) need special attention when stored in the lab



NIH Chemical Segregation Table: <https://ors.od.nih.gov/sr/dohs/Documents/chemical-segregation-table.pdf>

CHEMICAL STORAGE

5

DO store and dispose of reagents appropriately



Not Cluttered

Lip on Shelving

Labels and Containers in Good Condition

No Liquids Stored Above Eye Level of Shortest Person in the Lab (NO Chemicals Above Eye Level is Better)

Secondary Containment for Liquids and Liquids are Stored Below Solids

**Not good to store reagents in direct sunlight*

NIH Chemical Segregation Table: <https://ors.od.nih.gov/sr/dohs/Documents/chemical-segregation-table.pdf>

CHEMICAL STORAGE

5

DO store and dispose of reagents appropriately

What about flammables that need to be kept cold?



NIH Chemical Segregation Table: <https://ors.od.nih.gov/sr/dohs/Documents/chemical-segregation-table.pdf>

CHEMICAL STORAGE



Compressed Gases Require Thoughtful Storage Too!

5

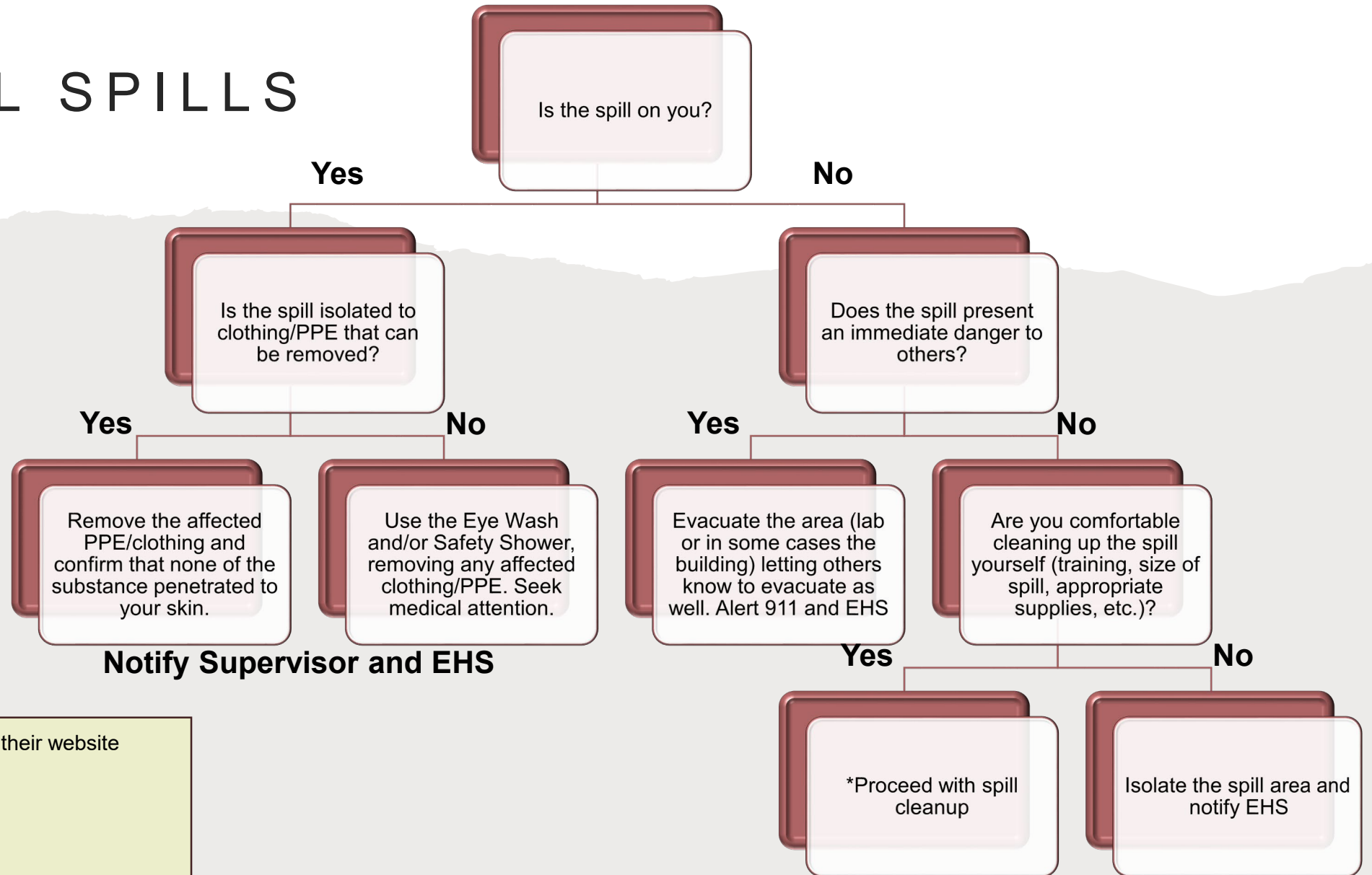
DO store and dispose of reagents appropriately

- Keep flammables and oxidizers separate (e.g. hydrogen and oxygen)
 - At least 20 feet or via a non-combustible physical barrier.
 - Flammable signage above or near flammable gasses
- Always secure cylinders before removing the safety cap and putting on a regulator
- Limit the number of cylinders stored in standard lab spaces to what is needed to maintain short-term operations. Labs should not be used to store large numbers of compressed gas cylinders.
- Appropriate regulator/hosing - Observe for Corrosion

EHS General Compressed Gas SOP/Fact Sheet:

<https://d2vxd53ymoe6ju.cloudfront.net/wp-content/uploads/sites/4/20170602090832/Compressed-Gas-SOP-06.2017.pdf>

CHEMICAL SPILLS



*EHS offers various types of spill kits on their website including:

- General
- Biological
- Acid
- Base
- Hydrofluoric Acid

<https://oehs.utah.edu/resource>

CHEMICAL SPILLS



Safety Shower/Eye Wash

- Remove contaminated clothing*
- Flush for at least 15 minutes
- Seek medical attention

*It is a good idea to have an extra pair of clothes in the lab.

Video: <https://youtu.be/6Yx9-dWgg3c?si=teOWluZ7OO4Nug0j>

Notify Supervisor and EHS



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LEGACY CHEMICALS ARE A BIG PROBLEM

- Be vigilant.
- You can help change this narrative!
- The U of U is a “mercury free” campus.



Bromine Pentafluoride Police Escort
~\$30,000



Glove Box Cleanout in 2024
Total Person Hours Required = 18 hrs



Name: Silver Azide
Amount: 25 g
Primary Hazard: Highly Explosive

Description	Unit	Fees	Estimated Cost
Mobilization/Demobilization (Little Rock, AR to Salt Lake City, UT)	Per Trip	\$ 2,635.00 (1)	\$ 2,635.00
Daily Rate (Labor, Lodging, Vehicle, Per Diem)	Per Day	\$ 1,875.00 (2)	\$ 3,750.00
Disposal of Silver Azide	Per Pipe	\$ 1,000.00 (1)	\$ 1,000.00
Rental of D.O.T. Pipe Shipper	Per Pipe	\$ 250.00 (1)	\$ 250.00
Transportation from Salt Lake City, UT to TSDF	Per Load	\$ 6,529.95 (1)	\$ 6,529.95
Transportation of Supplies	Per Load	\$ 500.00 (1)	\$ 500.00

Total Estimated Cost **\$ 14,664.95**

RESOURCES TO LEARN MORE

University Bridge Trainings

<https://utah.bridgeapp.com> (Choose the “Environmental Health and Safety (EHS)” Section)

- Chemical Hygiene ~ 45 min
- Laboratory Safety (10 steps) ~ 1-2 hrs
- Hazard Communications – HazCom ~ 11 min

American Chemical Society (ACS) Institute

<https://institute.acs.org/acs-center/lab-safety.html>

- Foundations of Chemical Safety and Risk Management (Free) ~ *17 hrs*
- Foundations for Storing, Organizing and Disposing of Chemicals in Educational Settings (Free) ~ *10 hrs*

University of Utah Environmental Health and Safety

<https://oehs.utah.edu/>

- Resource Center
- Forms/Checklists